Prioritized Technology: Technologies to Extract and Process Materials on Ocean Worlds for Life Detection

Technical Goals

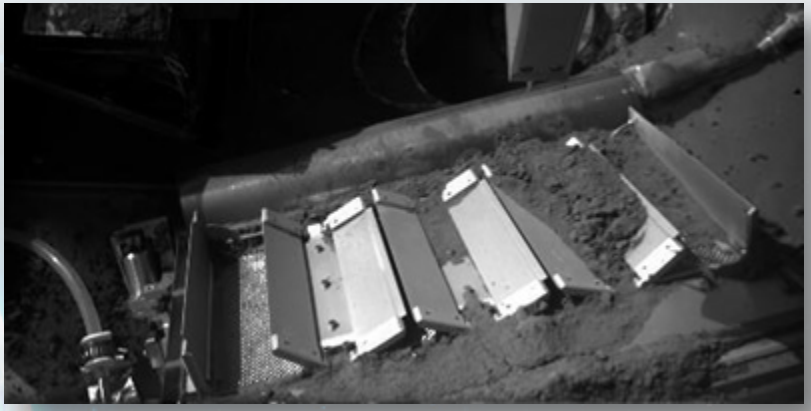
- Extract potential monomeric or polymeric biomarkers at < **1 ppb/wt** from ice, liquid **(< 5 mL**), or aerosol (> **10^6** submicron particles) without organic solvent.
- Process liquid or ice to separate or distinguish salts and minerals from biomarkers.
- Concentrate biomarkers to **pmol/mL** from **10's of mL** of ice or liquid.
- Amplify polymers with non-random repeating patterns.

Technical Status/ SOA

- SAM/ MSL – volume of solid material handled is 50 μL – extraction is by heat and derivatization chemistry.
- PHOENIX- Tega instrument – extraction by heat- handles ~ 40 μL
- PICASSO MACROS- solvent and heat extraction system for drill samples/LC → LDMS
- Urey instrument (descoped from EXOMARS)-subcritical H_2O extraction (SCWE)
- Supercritical CO_2 extraction (not yet adapted for space use)
- MSL/SAM hydrocarbon trap – 1 pmol/150 mg/soil (dry chemistry) – concentrates hydrocarbons by a factor ~ 1000
- MIDP-funded Precision Subsampling System – target layers of interest in core sample – 1 mm layer from 10 cm core
- PICASSO MILA Chemical Laptop microfluidic handling system – for example the fluorescent tagging capability
- PICASSO - Open tube ion/LC – (with focus on the sample prep portion of this instrument and not the analysis)

Mission Applications

- Release of biomarkers from natural their matrices will facilitate their identification.
- Determining extraction efficiencies under native conditions will enable determination of abundance of biomarkers in matrix.
- Quantitative isolation, concentration, and amplification expands the capability to detect biomarkers.



This image shows soil on the doors of the Thermal and Evolved Gas Analyzer (TEGA) onboard NASA's Phoenix Mars Lander.